Event Analysis

Acetonitrile Spill at the NSLS

Prepared by Andrew Ackerman

July 28, 2006

Purpose:

The analysis outlined in this report was conducted to determine the sequence of events and causes surrounding a spill of acetonitrile at the NSLS. Any lessons to be learned from this event can be disseminated in this report and a set of needed corrective actions is also outlined here. Personnel are encouraged to share this report will all who are interested.

Introduction:

The following personnel were in attendance at the analysis meeting. Except as noted, all are Brookhaven National Laboratory (BNL) personnel.

Andrew Ackerman
Mohammad Ali (DOE-BHSO)
Deborah Bauer
Nicholas Gmür
Sayan Gupta (Case Western Reserve University)
William Leigh-Manuell
Kathryn Warburton
Christopher Weilandics

The listed personnel met in an NSLS conference room for discussion and visited the spill site. The meeting and visit were completed in approximately 1.5 hours. The attendees employed a '5 Whys' approach to assembling the sequence details and analyzing the event. In addition to this meeting, Andrew Ackerman interviewed the NSLS Machine Operator, Operations Coordinators and Emergency Services personnel who responded to the scene and who are referenced in the following text to provide a complete gathering of information about the event. The NSLS Associate Chairman for ESH&Q and the BNL Chemistry Department ESH Coordinator also contributed to this report.

Sequence of events:

As noted above, the information that follows was collected from interviews with the personnel involved at the event, from discussion at the meeting, from written descriptions provided by two people at the scene, and from a review of the NSLS Operations Coordinator daily log book. Copies of the written descriptions and the log book are attached to this report. A copy of the BNL Fire Rescue Group report and a copy of the initial notification to the DOE Occurrence Reporting and Processing System (OPRS) are also attached.

The event occurred on Sunday, July 16, 2006. All of the times that follow are approximate.

~14:35: Approximately 1 liter of acetonitrile is spilled to the floor in building 725, room 1-161. A researcher was removing a 4 liter bottle from a flammable material storage cabinet when the bottle slipped from his hand, struck the floor, and broke. The bottle was not full; it contained approximately 1.5 liters of new reagent. Of that, about 500 ml remained contained and was salvaged and the remaining 1 liter spilled to the floor.

The researcher placed some adsorbent paper on the spill and telephoned the NSLS Control Room and reported the event to the NSLS Machine Operator. Both NSLS Operations Coordinators (Op Co) reported to the scene. One Op Co remained to assist. The second Op Co returned to the Control Room and called BNL Emergency Services on extension 2222.

The researcher and Op Co proceed with the clean up. Adsorbent pads from a nearby spill control kit are used. The spill is cleaned from the floor in about 10 minutes and the adsorbents and broken bottle are sealed in a plastic container and placed in the NSLS 90 day RCRA waste shed with the appropriate paperwork and labeling for transfer to the BNL Waste Management Facility.

It is noted that a floor drain is located between 1 and 2 meters from the spill site. It is estimated that between 100 and 200 ml of the solvent may have gone into that drain, but no solvent is actually seen pouring into the opening.

~14:45 Op Co contacts the NSLS Safety Officer. The Safety Officer contacts the BNL Primary Spill Responder and the NSLS Associate Chairman for ES&H.

~14:47: BNL Emergency Services report to the scene to find the spill cleaned. From their interviews with the personnel at the scene, they understand that the spill is cleaned and contained and that no release to the drain occurred. They understand that only about, “a test tube” amount spilled and based on that understanding determine no need to issue a page to the first responders. Emergency Services personnel leave the site at ~15:18.

~16:30
to
~18:00 The NSLS Safety Officer and Associate Chairman for ES&H arrive at the scene. Interviews with the researcher and Op Co involved in the clean up indicate some exposure to acetonitrile vapors. The Safety Officer and Associate Chairman research various references and share that information with the Op Co and researcher. It is determined that overexposure to the vapors is unlikely. The Op Co and researcher are advised to seek medical attention should any signs or symptoms of exposure develop. Subsequent conversations with the Op Co and researcher that evening and the following day yield no report of adverse health effect and no medical visit.

The BNL ORPS Categorizer is contacted by telephone.

~18:20 The BNL water treatment plant is shutdown and the site waste water is diverted to a holding pond as a precaution to avoid off-site release of acetonitrile to the Peconic River.

~19:00 The Primary Spill Responder arrives at the site to evaluate the risk of acetonitrile release to the drain.

~20:11 A BNL plumber meets the Primary Spill Responder at the scene to evaluate the drain and plumbing trap. The trap is in the concrete slab and hard to reach or see. It is decided to flush the drain with water to remove any residual acetonitrile that may be in the trap out of concern for the flammable nature of the solvent.

On Monday, July 17, 2006, the BNL water treatment plant is re-started and water is no longer diverted to the holding pond. On Tuesday, July 18, 2006, water samples are collected for acetonitrile analysis at the primary clarifier and the holding pond.

Related Information:

Room 1-161 is a wet chemistry set up laboratory that is used in support of several biology beam lines at the NSLS. The room measures approximately 10 meters long x 3 meters wide x 5 meters high and is well ventilated. Heating, Ventilation, and Air Conditioning (HVAC) service is delivered by three vents; two supplies and one exhaust, each measuring approximately 0.25 m^2 in area. There is also a standard laboratory exhaust hood exhausting air from the room. There is a noticeable breeze in the room.

Acetonitrile is stored and used in that laboratory for work with a commercial High Performance Liquid Chromatography (HPLC) system. The acetonitrile is stored in a flammable storage cabinet with secondary containment. The cabinet is on the floor below an inert atmosphere glove box.

HPLC work is routine in that laboratory. Acetonitrile is used as the 'mobile phase' of that system with a flow rate of ~50 µl/min for the full 8 hour day resulting in a total quantity need of ~24 ml.

Before beginning the spill clean up, the researcher consulted a National Fire Protection Association (NFPA) labeling guide booklet located on the laboratory entrance door. He found the toxicity value for acetonitrile to be, "2". No other references were consulted. No respiratory protection was used and only the Op Co donned disposable nitrile gloves before approaching the spill clean up. A well stocked spill control kit was located several meters from the spill that contained sufficient adsorbents to complete the clean up.

The NSLS Operations Group attends annual spill response training conducted by the NSLS Safety Officer. That training focuses on the written spill response procedure included as an attachment to this report.

Spill Consequences:

Waste water sample analysis results from the BNL sewage treatment plant holding pond indicate acetonitrile concentrations in the water between 17 and 31 micrograms/liter. This indicates that the spill did enter the floor drain as suspected. Based on the reported concentration and the 1.9×10^6 liter volume of diverted water, it is estimated that approximately 50 ml of acetonitrile entered the drain.

Calculation of the potential acetonitrile exposures to personnel indicates that exposures were well below the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) and the National Institute of Occupational Safety and Health (NIOSH) Immediately Dangerous to Life and Health (IDLH) level. That calculation is an estimate and contains assumptions. Without sampling data, estimation is all that can be done. A copy of that calculation is attached to this report.

Causal Analysis:

Two issues were considered during the event discussion and causal analysis; potential acetonitrile exposures to personnel and possible release of the solvent to the environment. A, "5 Whys" approach was used to analyze the cause of the spill and to determine what changes in practice could help avoid a recurrence or reduce the consequences of a future spill.

Direct Cause

The researcher had a poor grip on the bottle handle when removing it from the cabinet and that resulted in the bottle impact to the floor and spill.

Contributing Causes

- The flammable storage cabinet position is awkward. It is low to the ground and below a glove box. That glove box is under positive pressure resulting in the arm length gloves protruding from the box directly above the flammable storage cabinet.

- The storage bottle is glass rather than unbreakable plastic.

- The storage cabinet is located within 2 meters of the laboratory floor drain.

Analysis and Lessons to Learn:

Having a spill control kit located near the wet chemistry laboratory is a good practice and allowed the personnel involved to act quickly to contain and clean the spill. The NSLS maintains these spill control kits throughout the facility at appropriate locations and assures that the inventory in each kit is kept complete through the Tier I inspection program.

Providing training to the Operations Coordinators in spill response is another good practice. The NSLS Operations staff members are not, “first responders” for spill control, but are always the first contact for events at the facility and so need some preparation for response to a chemical spill. The difficulty here is in evaluating each event and determining appropriate response given the limited training and personnel protection equipment available to this group. NSLS policy and training emphasizes protection of the individual and the Operations group is instructed to approach any spill with caution and to rely on the BNL Emergency Services personnel for spills determined to present an emergency or significant risk to personnel. The Operations Group spill response is focused on handling non-emergency spills where there assistance can help quickly contain a small mess or help avoid an unnecessary release to the environment.

The NSLS Operations group response to this event was quick, decisive, and professional. As instructed by procedure and training, they asked the researcher about the material spilled before proceeding and were informed that the liquid was similar to acetone. Based on that, the Op Co donned gloves and proceeded to help with the clean up. The researcher had consulted the NFPA labeling booklet as described above, but no other reference was checked and so both the

researcher and Op Co had an incomplete understanding of the risks presented by acetonitrile.

It turns out that personnel exposures from this event were not significant, but it is clear that response was made without complete information. Review of the Operations Group spill response procedure indicates that improvement to the guidance included to manage the difficult issue of gathering sufficient information and judging appropriate response is needed.

The flammable liquid storage cabinet in room 1-161 is located close to the floor drain. Liquid reagent storage could be moved more distant from the drain, but that is not likely to significantly reduce the risk of spill to the drain. Reagents are used throughout the laboratory and the storage cabinets all have secondary containment for the stored liquids. Rather than attempt to relocate the liquid reagent storage cabinet in this and all the other wet chemistry laboratories, use of plugs for these drains will be investigated. Ideally, the plug chosen should present no tripping hazard and be easily removable should the drain be needed for a significant water spill.

Liquid storage in glass presents obvious risk of breakage and spill so switching to plastic containers was considered. Use of glass containers is standard in wet chemistry laboratories. Use of plastic containers adds significant cost. Although storage in plastic will help reduce the risk of spill, all work with these reagents is within standard chemistry glassware that remains breakable. Whenever personnel are working with liquids, some spill is inevitable and for the small scale wet chemistry employed at the NSLS, a sensible approach is to mitigate the consequences of a spill by requiring storage in small (1 liter or less) containers and allowing the use of glass.

There was some miscommunication between the BNL Fire Rescue Group and the personnel at the scene that resulted in the Fire Rescue personnel not realizing how much solvent was spilled. That misunderstanding resulted in no activation of the first responder paging system. The primary spill responder was notified separately and so response to the potential environmental concerns occurred. Some confusion at events like this is understandable and the BNL Fire Rescue Group response was fast and professional. The miscommunication was unfortunate, but not indicative of any procedural or response system problem.

This event resulted in some uncertainty about how best to assess the likelihood of spill to the floor drain. As there was no first responder page issued, the BNL Industrial Hygiene Group was not notified, but had they been, they may have helped determine if acetonitrile entered the drain through use of real time flammable vapor monitoring equipment. The primary spill responder was notified, but had no equipment or guidance for evaluating the likelihood of spill to the drain. Even very small volume releases (in the ml range) can pose high environmental rule compliance risk. Any release to a drain needs to be quickly

evaluated by environmental compliance personnel. If there is uncertainty and no definitive method available to determine if a spill has entered a drain, a conservative approach is warranted and waste water should be diverted at the treatment plant.

The BNL SBMS subject area for spill response provides good guidance on personnel to be contacted and action to be taken to mitigate the emergency aspect of spills, but lacks guidance for evaluating the spill and determining if material has entered a drain. The subject area also lacks procedure for cleaning a spill once the emergency has been mitigated. The procedure indicates that the spill owner or the department where the spill occurs is responsible for assuring proper clean up and disposal, but gives no guidance and does not identify any resources available for that process.

Corrective Actions

The actions that follow are based on the analysis above and are intended to reduce the risk of recurrence and consequences of another spill at the NSLS. Each action should be entered to the NSLS family Action Tracking System (ATS) for tracking to completion.

1) Experiment ESH review and procurement ESH review should continue to include minimization of the amount of liquid reagents allowed at the NSLS. Without convincing justification and experiment need, no liquid reagent containers should be allowed in the facility that exceed 1 liter in volume. Exception to this 1 liter requirement must be received in writing from the NSLS Safety Officer.

   Responsibility: NSLS Experiment Review Coordinators
   NSLS Safety Engineer assigned to procurement review.

   Due Date: Ongoing

2) The NSLS Procedures and Requirements Manual (PRM) section on experiment safety review (PRM 1.3.5a) and the PRM section for storage, usage, containment and transfer of toxic and hazardous chemicals (PRM 2.1.2) and the Job Risk Assessments for Chemical Use (LS-JRA-021 & LS-JRA-0022) must be updated to include the new 1 liter requirement.

   Responsibility: PRM's -- NSLS ESH Coordinator
   JRA's – NSLS ESH Specialist

   Due Date: October 30, 2006

3) The NSLS Laboratory Stewards must assure that no liquid reagent containers in their laboratories exceed 1 liter in volume. Reagents in existing larger containers may be transferred to smaller secondary containers or discarded. The NSLS Safety Engineer assigned responsibility for maintenance of the BNL Chemical Management System will complete an audit of chemical storage in the facility to assure compliance with this requirement.

   Responsibility: NSLS Laboratory Stewards
   NSLS Safety Engineer

   Due Date: January 31, 2007

4) The NSLS Operations Group chemical spill response procedure must be reviewed and updated to include better guidance for evaluating the risks associated with spills.

   Responsibility: NSLS Safety Officer

   Due Date: October 31, 2006

5) Use of plugs for the floor drains in the NSLS wet chemistry laboratories must be evaluated.

   Responsibility: NSLS Safety Officer

   Due Date: October 31, 2006

6) Review of the BNL SBMS Subject Area for spill response should be suggested to the management system steward for that area. It should be suggested that the review include attention to the resources available to the primary spill responder and to the departments for spill evaluation and clean up.

   Responsibility: NSLS Environmental Compliance Representative

   Due Date: August 31, 2006

Attachments.

Spill Event Description
Prepared by Deborah Bauer

7/16/06 Acetonitrile Spill @ the NSLS Responder: Deborah Bauer

Time Line

3:52: Call Received on ESD #1 from Andrew Ackerman regarding spill of 1 L acetonitrile in lab at NSLS. Most material recovered, but small amount (1 cup or less) to drain around 3 PM. Researcher (Sayan Gupta) and Op Co (Tom McDonald) called x222 and cleaned up. Andrew got spill phone # from SBMS.

4:00: Called B. Lee, who said to contact Site Shift Supervisor (Bob Bellandro) to determine whether the drain had a trap. The material was likely caught in the trap. Need to determine how much.

4:03: Called Fire Chief (Roy Barone) who explained that they responded and the researcher stated that a test tube broke, and approximately 5 mL spilled. No release to drain. Material cleaned up. The Chief had Site Super come down to inspect the drain and it did not appear to be effected. Decided that if any material did go to drain, it would have evaporated. Chief decided there was no event, and did not put out spill page.

4:05: Called Andrew back. He said he was going on site to verify which story was correct.

5:15: Andrew called me back. First story accurate. Andrew then called the ORPS categorizer, Mike Buckley.

From 5:15 – 6:00
Researched RQ for acetonitrile (1 lb). Release amount (1 cup) = .4 lbs. Spill not reportable. Spoke with Mike Buckley, Fire Chief and Bob Lee. Fire Chief: Contact Site Supervisor to get a plumber to determine whether the drain had a trap. If no trap, put STP in diversion mode. If there is a trap, try to recover material from trap to avoid release. Chief would call me back so I could meet the Site Shift Super and plumber when they came in.

6:13: Chief calls me: Likely no traps, floor on slab. Site Super still trying to verify.

6:21: Chief calls me: Diverting plant to be conservative as it's still unknown whether drain has a trap. Will contact me when plumber arrives.

7:00: Meet Chief and Site Super. Go to Lab 1-161 where event occurred. Speak with researcher who says about 5 mL went to the drain.

8:11: Site Super removes drain cover. Drain approx 3 feet deep and completely dry. No solvent odor. Still no information on traps.

Approx 8:20: Plumber arrives. States drain has a trap, but it is under slab and not accessible.

Options:

1. Web Vac – not chosen due to flammability concern.
2. Try to absorb material in trap with absorbent pad – not chosen as the trap is deep and after a "L" turn in the pipe. Would not be able to removed pad.

The overriding belief was that any amount of the spilled material that got to the drain evaporated before it got all the way down the 3 ft deep pipe. However, if any material was in the trap, it caused a safety issue as it was flammable and needed to be removed. Plumber recommended flushing the line.

8:30 I called Bob to tell him options via voicemail. Go back and give plumber OK to flush. Received message back from Bob after leaving 725 not to flush.

Acetonitrile Spill Event Description
Prepared by Sayan Gupta

Bob and Andrew,

The below is the report for the incidence -

Incidence Report for Acentonitrile spillage in Lab 161, 07/16/2006, ~ 14:30hr.

4 liter acetonitrile storage container was slipped off my hand and fell down side way on the floor. This happened just after I took it out from the flammable storage cabinet. The container was less than an inch above the floor before it fell down. At the time of impact the container was less than half filled. In one side of the container, the middle portion got shattered resulting spillage of ~ 1 liter acetonitrile on the floor. The partly broken container was still holding ~ 500 ml of acetonitrile inside it. Most of the spilled acetonitrile was (the flow was directional) under the glove box and experimental bench which are situated adjacent to the storage cabinet for the flammable liquid and hazardous materials.

Immediately after the spillage I used tissue paper to soak the spilled acetoniltrile and then informed control room about the occurrence. The occurrence was explained to Tom McDonalds and Kathy Warburton. More spill absorber was used to soak the reaming spilled acetonitrile which was seen to evaporating very fast.

Very small amount was noticed to move towards the drain that is situated 3-4 ft from the flammable storage cabinet. It was observe that such flow was depleted rapidly by the very high evaporation rate of acetonitrile.

The remaining acetionitrile that was inside the broken container was placed in the fume hood inside a secondary container and transferred in the sealed container.

The soaking pads, tissues, broken glass pieces and the broken glass container were transferred to the 13gal plastic waste drum and removed from the lab 161 as hazardous waste to the hazardous waste material area.

Later I had explained the incidence to the officer from BNL fire department, environmental management departments, William Casey (Bob Casey) and Andrew Ackerman.

Thanking you,
Sayan

Text used for initial notification to the DOE Occurrence Reporting and Processing System (OPRS)

CHEMICAL SPILL; WET CHEMISTRY LABORATORY, BLDG 725, RM 1-161
MONDAY; JULY 17, 2006
PREPARED BY ANDREW ACKERMAN

Event Description:

On Sunday, July 16, 2006, approximately 1 liter of acetonitrile was spilled to the floor in laboratory room 1-161. A researcher was removing a 1 gallon bottle of the solvent from a flammable storage cabinet when the bottle slipped from his hand, hit the floor, and broke. The bottle was less than half full of new, unused acetonitrile. Approximately 500 ml remained contained in the broken bottle and was transferred to another container and stored in a laboratory exhaust hood. Approximately 1 liter was spilled to the floor. A floor drain is located between 1 and 2 meters from the spill site. The spill was directed away from the drain on impact, but some amount, estimated between 100 and 200 ml (80 – 160 g) entered the drain. That drain is directed to the sanitary waste water system.

Adsorbent paper was immediately placed on the spill and the NSLS Control Room was notified. An NSLS Operations Coordinator proceeded to the scene and worked with the researcher to contain and clean the spill with adsorbent pads from an adjacent spill control kit. Personnel at the site estimated that the clean up was complete in approximately 10 minutes. The adsorbent materials and broken bottle were placed in a sealed plastic container that was labeled and placed in the NSLS RCRA 90 day storage shed for pick up and the appropriate paperwork was completed.

Concurrent with the clean up, BNL Emergency Services was called and responded to the scene. The NSLS Safety Officer and NSLS Associate Chairman for ESH&Q were called at home and proceeded to the scene. The BNL Environmental & Waste Management Services Environmental Compliance group was contacted and the individual on call also proceeded to the scene. The ORPS categorizer was notified.

Investigation into the details of this event and personnel response continues. A formal critique will be conducted to capture the proper information and determine what lessons might be learned from this experience. From discussions with personnel at the scene and with the BNL environmental compliance group, the following is known:

- Personnel involved experienced no adverse health effects.
- Although some amount of solvent entered the drain, there was no off-site environmental release and no requirement to notify regulatory agencies.
- BNL notification was timely.

More information, including a sequence of events, will be distributed once the critique is completed.

NL Fire/Rescue Group

A

FDID	State	Incident Date	Station	Incident Number	Exposure
52482	NY	07/16/2006	HQ	0000148	000

☐ Delete ☐ Change ☐ No Activity

NFIRS-1 Basic

B Location

☐ Address on Wildland Form

Census Tract

☑ Street Address ☐ Intersection ☐ In front of ☐ Rear of ☐ Adjacent to ☐ Directions

Number	Prefix	Street	Type	Suffix
75		Brookhaven	AVE	

Apt/Suite	City	State	Zip Code
	Upton	NY	11973

Cross Street or Directions, as applicable

C Incident Type

422 Chemical spill or leak

D Aid Given or Received

1 ☐ Received
2 ☐ Automatic Rec'vd
3 ☐ Given
4 ☐ Automatic Given
5 ☐ Other Aid Given
N ☑ None

Their FDID

Their State

0000000 Their Incident

E1 Dates & Times

		Mon. Day	Year	Time
Alarm		07/16/06		14:47
Arrival	☑ Arrival	07/16/06		14:50
Control	☐ Control	00/00/00		00:00
Last Unit Clear	☑ Last Unit Clear	07/16/06		15:18

E2 Shifts / Alarms

Shift	Alarms	Dist.
Re	0	

E3 Special Studies

ID#	Value

F Actions Taken

86 Investigate

Primary Action Taken (1)

Additional Action Taken (2)

Additional Action Taken (3)

G1 Resources

	Apparatus	Personnel
Suppression	0	0
EMS	0	0
Other	2	4

☐ Check if counts include mutual aid resources

G2 Dollar Loss & Values

LOSSES:		NONE
Property	0	☑
Contents	0	☑
PRE-INCIDENT VALUE		
Property	0	☑
Contents	0	☑

Completed Modules

☐ Fire-2
☐ Structure-3
☐ Civ. Casualty-4
☐ Fire Casualty-5
☐ EMS-6
☐ Hazmat-7
☐ Wildland-8
☐ Apparatus-9
☐ Personnel-10
☐ Arson-11

H1 Casualties

☑ None

	Deaths	Inj.
Fire Service	0	0
Civilian	0	0

H2 Detector Alerted Occupants

1 ☐ Yes
2 ☐ No
U ☐ Unknown

H3 Hazmat Release

N ☑ None
1 ☐ Natural Gas
2 ☐ Propane Gas
3 ☐ Gasoline
4 ☐ Kerosene
5 ☐ Diesel Fuel/Fuel Oil
6 ☐ Household Solvents
7 ☐ Motor Oil
8 ☐ Paint
0 ☐ Other

I Mixed Use Property

NN ☑ Not Mixed
10 ☐ Assembly Use
20 ☐ Education Use
33 ☐ Medical Use
40 ☐ Residential Use
51 ☐ Row of Stores
53 ☐ Enclosed Mall
58 ☐ Business & Resid.
59 ☐ Office Use
60 ☐ Industrial Use
63 ☐ Military Use
65 ☐ Farm Use
00 ☐ Other Mixed Use

1st Company to Arrive: Car-1

*Building # 0725
*Zone
Manhours 2.0

J Property Use

629 Laboratory or science lababoratory

BNL Fire/Rescue G up | 07/16/2006 | 0000148 | 0

K1 Person / Entity Involved

Business name (if applicable) | Phone

Prefix | First Name | MI | Last Name | Suffix

Check if same address as incident

75 (Number) | Prefix | Brookhaven (Street or Highway) | AVE (Street Type) | Suffix

Post Office Box | Apt./Suite/Room | Upton (City)

NY (State) | 11973 (Zip)

K2 Owner

Same as Person Involved

NSLS (Business name (if applicable)) | Phone

Prefix | Gerry (First Name) | MI | Van Derlaske (Last Name) | Suffix

Check if same address as incident

75 (Number) | Prefix | Brookhaven (Street or Highway) | AVE (Street Type) | Suffix

Post Office Box | Apt./Suite/Room | Upton (City)

NY (State) | 11973 (Zip)

L Remarks

Recieved call from Mr.Santana of a chemical spill of Acetonitrile located in room 1-161 upon arrival found out it was about a test tube of product that was spilled and had been cleaned up .Noticed a drain in floor ask if any product went down drain Mr.Gupta told Fire Captain that product spilled away from drain no other action was taken by Fire/Rescue at this time

M Authorization

Officer in charge ID		Position or Rank	Assignment	Date
15099	x Roy Barone	Captain	Incident C	07/16/2006
Member Making Report				
15099	x Roy Barone	Captain	Incident C	07/16/2006

NSLS Control Room Logbook Spill Entry

Date 2/4/97 Tuesday
Day / Week

Shift Period 0700 2120

Tom M Dave / K Warburton
OPCO OPCO / T.W.

MASTER KEY SIGN-OUT

Key	Shift Start	Transfer	Transfer	Shift End
#1	Cab			Cab
#2	Cab			Cab

X1A2	X17B1	X28 4/0	U2A	U
X1B	X17C	X	U	U
X4A	X18B	X	U4A	U
X4C	X19A	X	U4B	U
X6A	X19C	X	U5BPM	U
X6B	X20A	X	U	U
X7A	X20C	X	U7A	U
X7B	X21A	X	U	U
X8A	X22C	X	U10B	U
X8C	X23A2	X	U11A	U
X10B	X23B	X	U12A	U
X10C	X25A	X	U	U
X11A	X26A 4/0	X	U13AB	U
X11B	X26C	X	U	U
X12A	X27A	X	U	U
X12B	X27B	X	U	U
X14A	X27C	X	U	U
X15A	X28B	X	U	U
X15B	X	X	U	U

0900 Reviewed shift log
0940 Full tour of experimental flr All OK
1100 Full tour of experimental flr all OK
1224 X28 - enabled on 2667
1257 X19A - 2618 posted
1309 Full Tour of Xray + VUV floors - Quiet
1332 X25 - 4946 posted
X 1435 Chemical Spill reported by S. Gupta - Rm 1-161 <liter. some entered chain in room. Contacted Fire/Rescue + A. Ackerman - Spill cleaned up by OPCO + Gupta Chemical Name: Acetonenitrile. Spill was cleaned up with white absorbant pads kept in the spill station by X7. Cleanup took 5-10 minutes with solvent on the ground about 5 minutes before cleanup started. All glass and cleanup pads put in Hazardous Waste bucket, labeled and put in storage area by S. Gupta.
1625 B. Casey arrived
1640 A. Ackerman arrived. Reviewed incident info w/ both Casey + Ackerman Catagorizer will be called.
1740 R. Church notified of spill
1757 Full tour of Xray + VUV floors - Quiet - found water coming out from under wall by MER4. Checked inside MER4. ~1/3 floor covered in water. Site Super notified by Machine Operator
1958 Process log completed
2033 Full Tour of Xray + VUV floors - Quiet X28 4/0 X26D 4/0 user request
2151 X25A - 4952 posted

ACETONITRILE SPILL EXPOSURE EVALUATION
JULY 18, 2006
PREPARED BY ANDREW ACKERMAN

Approximately 1 liter of acetonitrile spilled to the floor. Clean up of the spill with adsorbents was completed in about 10 minutes. This document is intended to estimate the resulting airborne concentration of acetonitrile and the potential inhalation exposures to personnel involved in the clean up. Two people cleaned the spill.

Acetonitrile physical data:

Specific Gravity: 0.78
Molecular Weight: 41.1
Vapor Pressure: 73 mmHg

1.0 part per million (ppm) = 1.68 mg/m^3

Exposure Limits:

NIOSH Recommended Exposure Limit (REL):
20 ppm (34 mg/m^3)

OSHA Permissible Exposure Limit (PEL):
40 ppm (70 mg/m^3)

NIOSH Immediately Dangerous to Life and Health (IDLH) value:
500 ppm (840 mg/m^3)

Analysis:

For this estimate, it is assumed that 50 ml of acetonitrile evaporated into ½ of the volume of the room and was evenly distributed.

The room where the spill occurred is roughly rectangular in shape and measures approximately 10 meters long x 3 meters wide x 5 meters high.

Volume of a rectangle = $L \cdot W \cdot H$

(10 m) (3 m) (5 m) = 150 m^3

150 m^3 / 2 = 75 m^3

Assume 50 ml of acetonitrile evaporated into ½ the room volume:

(0.8 g/ml) (50 ml) = 40 g = 40,000 mg
(40,000 mg) / (75 m^3) = 533 mg/m^3 = acetonitrile concentration in ½ the room volume.

NIOSH IDLH Comparison:

533 mg/m^3 / 840 mg/m^3 = 0.63

OSHA 8 hr Time Weighted Average calculation:

(533 mg/m^3) (10 min) / 480 minutes = 11 mg/m^3

OSHA 8 hr Time Weighted Average comparison:

(11 mg/m^3) / (70 mg/m^3) = 0.16

CONCLUSION

The 10 minute exposure was well below the NIOSH IDLH value and the OSHA PEL.

Subject: **NSLS Operations Group Chemical Spill Response**		
Prepared By: Andrew Ackerman	**Approved By:** Richard Heese	**Approved By:** Randolph Church

*Document must contain approved signatures for validity.

1.0 PURPOSE

This procedure is to provide guidance to the NSLS Operations Staff for response to chemical spills at the National Synchrotron Light Source.

2.0 SCOPE

The Operations Coordinators are the first contact for all issues relating to the NSLS Experimental Program. Many experiments require some wet chemistry and Users bring a wide variety of chemicals to the Light Source as part of their study. Spills are inevitable and operations will be contacted for assistance. Since quantities of hazardous materials are generally small, most spills will not generate an emergency condition and should be readily cleaned up by the responsible party, supported as needed by NSLS Operations and ESH Staff.

The Op Co's have an important support role in response to spills, but are **not emergency response personnel**. They are needed to make initial judgments regarding the potential consequences of a spill and to initiate protective actions for personnel, the building, and the environment consistent with this procedure.

THE BNL EMERGENCY SERVICES PERSONNEL WILL HANDLE ANY SPILL THAT IS JUDGED TO PRESENT AN EMERGENCY SITUATION.

3.0 RESPONSIBILITY

3.1 Users/Scientific Staff: NSLS Users and Scientific Staff are responsible for reporting, controlling, and cleaning small chemical spills that result from their work at the facility. He/She shall:

1. Immediately report any chemical spill to the NSLS Control Room.
2. Act to contain the spilled material.
3. Remain available to report information about the spilled material.
4. Clean up and package the spilled material for disposal.
5. Call BNL Emergency Services (ext. 2222) and the NSLS Control Room (2550) if the spill presents an emergency (see Chemical Spill Guidelines below).

3.2 NSLS ES&H Staff: The NSLS ES&H Staff is responsible for providing guidance on cleaning and containing chemical spills and for assisting with incident response.

3.3 NSLS Operations Coordinators: The NSLS Operations Coordinators will help

evaluate chemical spills that take place on the NSLS Experimental Floors. He/She shall:

1. Report to the spill site to evaluate the spill
2. Summon BNL Emergency Services if an emergency is judged to exist.
3. Ensure that the scene is controlled to prevent harm to individuals by restricting access to the spill location, including, if necessary, evacuating the entire building
4. If safe, take initial actions to control the spread of the spill to drains.
5. Assist with spill response (Outlined below).
6. Contact the NSLS ES&H Staff for assistance.
7. Maintain communications with the NSLS Control Room.

3.4 NSLS Machine Operator: The NSLS Machine Operator is responsible for coordinating communications between the Op Co at the spill scene and the remainder of personnel at the facility. He/She shall:

1. Collect information from the Op Co at the scene.
2. Make appropriate announcements over the NSLS Public Address system.
3. Initiate a building evacuation as necessary.

4.0 SPILL RESPONSE

In responding to a spill, the first priority of the Operations Coordinator is to reduce or eliminate the potential for harm to individuals resulting from the spill. The Operations Coordinator shall take no action that places him/herself or other personnel on the experimental floors in danger. A second priority shall be to contain the spill to prevent release to the environment if containment can be accomplished without risk of personnel injury.

Upon arrival to the scene, the Opco shall:

4.1 Collect the following information:

1. Identification of the material released.
2. An approximation of the quantity released.
3. A brief description of the incident and actions taken.

4.2 Evaluate: Evaluate conditions and determine if the situation presents significant risk to personnel, equipment, or the environment and should be considered an emergency. See guidance below. Contact a member of the NSLS ES&H Staff for assistance if time permits.

4.3 Control:

4.3.1 EMERGENCIES. Emergencies require assistance from the BNL Emergency Services group. BNL Emergency Services can be reached on extension 2222 or 911. Upon determination that an emergency exists, the Op Co will take the following action:

1. Move personnel away from the scene. Conditions will determine how much clearance is needed. A complete building evacuation could be necessary.
2. Call BNL Emergency Services and the NSLS Control Room.
3. Be prepared to provide the information collected above (Sec 4.1) and to report the precise location of the incident.

4.3.2 NON-EMERGENCIES. The owner of the spilled material will take the following action to contain and clean spills judged not to present an emergency. The Op Co reporting to the scene will assist, but **the primary responsibility for clean up and disposal of the spill rests with the owner of the spilled material.**

1. Move personnel away as necessary.
2. Maintain contact with the Control Room. Direct the NSLS Machine Operator in making appropriate building announcements to keep personnel informed as necessary.
3. Don neoprene gloves and goggles (available in room 1-150). Overalls and boots are also available if needed, however, it is expected that small, non-emergency spills will only require gloves and eye protection.
4. Apply an appropriate adsorbent to the spill (See Chemical Spill Guidelines below). **Where possible, prevent the spilled liquid from entering any drains.**

NOTE: Any chemical release to a drain is an environmental concern and must be reported to BNL Emergency Services (ext. 2222). Drains in building 725 are directed to the BNL sanitary water system and ultimately to the Peconic River. Releases to the drain may be reportable to the US EPA and must be reported so that determination can be made.

Any petroleum product spill within the building greater than 5 gallons must be reported to BNL Emergency Services. Spills exterior to the building are to be handled in the same manner as those within the building. Protect the drains if possible and attempt to contain the material to asphalt or concrete surfaces. Any spill to the grass must be reported to BNL Emergency Services to determine if notification to external regulators is required.

5. Collect the wet adsorbent and seal it in the plastic containers located in room 1-150.
6. Label the container and complete the paperwork necessary for disposal through the BNL Waste Management Facility.

6. TRAINING

6.1 NSLS Users/Scientific Staff: NSLS Users and Scientific Staff that use hazardous materials have sufficient knowledge and experience to handle small spills that do not present an emergency.

6.2 NSLS Operations Staff & Technicians: NSLS Operations Staff and Technicians must review this procedure with their supervisors and a member of the NSLS ES&H Staff.

Chemical Spill Guidelines

Guidelines for response to chemical spills follow:

Scope

All sorts of materials come to the NSLS for study. Most materials arrive in small quantities; typically just a few milliliters of solution or grams of solid. The following materials are likely to be used in larger quantities and are stored in chemical storage cabinets around the experimental floor:

Solvents:	Alcohols, Hexane, Acetone, Toluene.
Acids:	Hydroflouric acid, Hydrochloric acid, Sulfuric acid, Acetic acid, Nitric Acid.
Other:	Pump oil, Hydrogen Peroxide

Significant spills are most likely to include one of the liquids listed above.

Resources

NSLS maintains a supply of adsorbents and gloves in spill stations distributed on the experimental floor and in room 1-150. A map is attached below.

The Spill Stations contain:

- Universal adsorbent pillows and pads (white) (may be used for any liquid spill)
- Alkaline neutralizer (may be used with all alkaline solutions)
- Acid neutralizer (may be used with all acids including Hydroflouric acid)
- Mercury adsorbent
- Gloves; Silver Shield and Nitrile
- Goggles
- Tyvek coveralls
- Waste bags
- Calcium Gluconate Gel (for HF burns)

Room 1-150 contains:

- Universal adsorbent pads (**black**) (may be used for any liquid spill)
- Oil adsorbent pads (**white**) (for oils only, including PCB oils)
- Alkaline neutralizer (may be used with all alkaline solutions)
- Acid neutralizer (may be used with all acids including Hydroflouric acid)
- Mercury adsorbent
- Granular adsorbent (crushed corn cob) (may be used for most spills; not for use with hydroflouric acid, concentrated nitric acid, or concentrated hydrogen peroxide)
- Gloves, Tyvek coveralls, bags, goggles

Response

Appropriate spill response requires some knowledge of what has spilled, where it has spilled, and how much has spilled. With that information, a judgement as to how to proceed can be made. The Op Co responding to the site must evaluate the conditions and determine what help is needed. Any member of the NSLS E&H Staff can assist with that evaluation. General guidelines follow:

- Significant risk of fire or personnel hazard is an emergency that requires notification and request for assistance to the BNL Emergency Services Group at extension 2222.

- The chemical user can often handle small volume (<500 ml) spills of the liquids listed above. All cleaning materials should be collected for disposal through the BNL Hazardous Waste Management Facility.

- Many solvents and all alcohols are flammable. Acetone has a very low flash point and ignites more easily than the other solvents. An unconfined spill of flammable liquid exceeding one liter is an emergency situation and requires removal of personnel from the immediate area and a call to extension 2222.

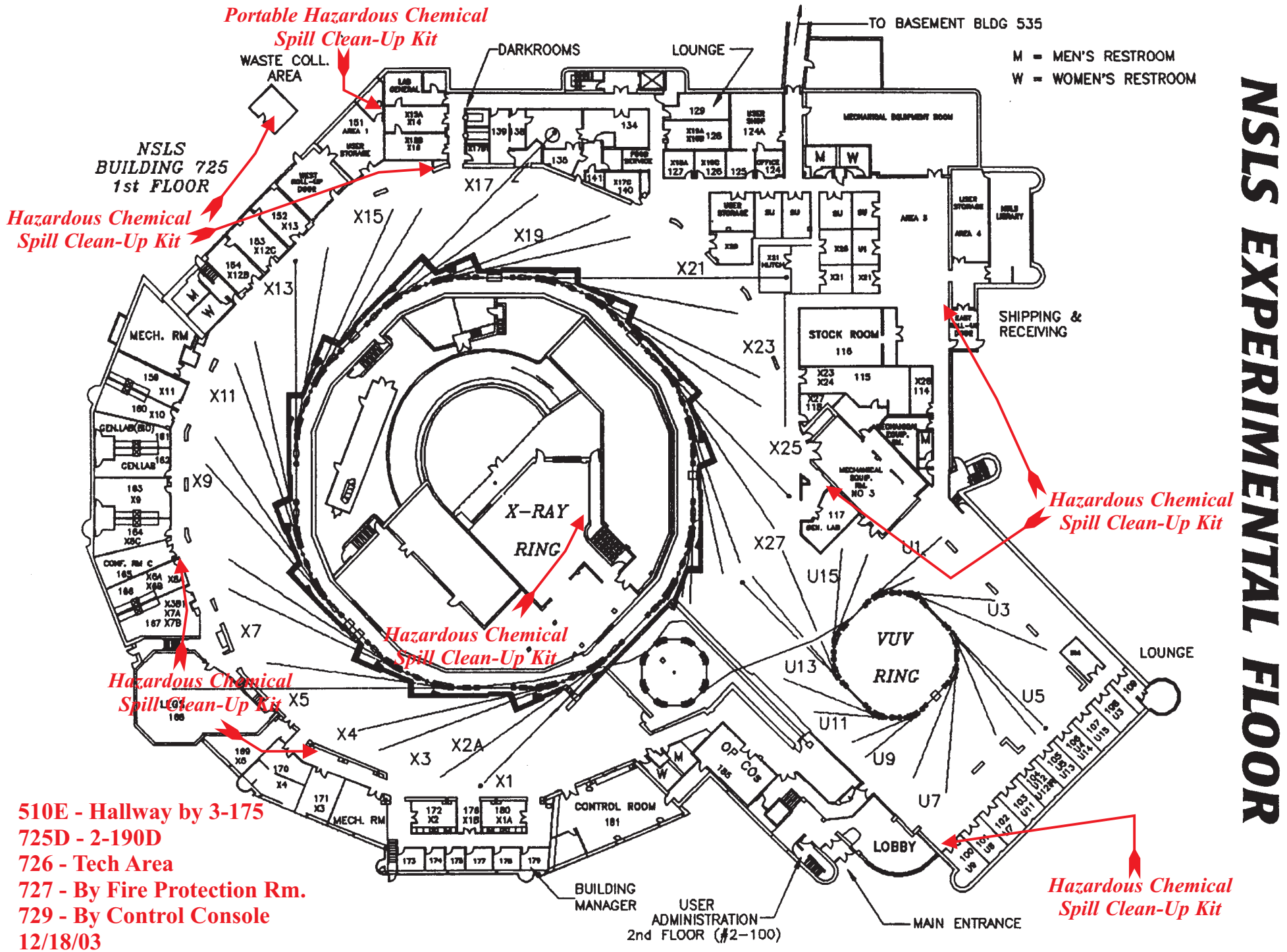
- Acid solutions are corrosive, reactive, and often release irritating vapors. An unconfined acid solution spill exceeding one liter is an emergency situation and requires removal of personnel from the immediate area and a call to extension 2222. Any spill of hydroflouric acid requires assistance from the BNL Emergency Services personnel.

- Concentrated (>50%) hydrogen peroxide is extremely reactive and could ignite fuel materials. Hydrogen peroxide solutions at a concentration greater than 10% are irritating to the skin and eyes. Any spill of concentrated hydrogen peroxide (>50%) requires assistance from the BNL Emergency Services personnel.

- Benzene and chloroform are occasionally in use at the NSLS. These are liquid carcinogens that evaporate fast and so present significant risk of inhalation. Benzene is flammable. Spills of these two liquids exceeding 50 ml require assistance from the BNL Emergency Services personnel.

- Pump oil is not considered a hazardous material and is non-flammable. It is messy and slippery. Pump oil clean up materials should be collected for disposal through the BNL Hazardous Waste Management Facility. It is treated as, “Industrial Waste”.

Map of the Spill Stations



NSLS EXPERIMENTAL FLOOR

510E - Hallway by 3-175
725D - 2-190D
726 - Tech Area
727 - By Fire Protection Rm.
729 - By Control Console
12/18/03